

RESPONSE UNDER 1.114(c)
Application No.: 10/725,327
Atty Docket No.: Q78609

As set forth in the Response Under 37 C.F.R. § 1.116 filed on April 4, 2005, the present direction as set forth in claim 1 is directed to a photocatalytic powder comprising titanium dioxide fine particles comprising an anionically active substance, wherein the fine particles have an electrokinetic potential of from about -100 mV to -10 mV in an aqueous environment at pH 5, and wherein the titanium dioxide fine particles are obtained by a vapor phase reaction or a wet-hydrolyzing.

The present direction as set forth in claim 2 is directed to a photocatalytic powder comprising titanium dioxide fine particles comprising an anionically active substance, wherein the fine particles have an electrokinetic potential of from about -100 mV to -10 mV in an aqueous environment at pH 5, and wherein the crystal form of the titanium dioxide fine particles is anatase and/or brookite.

In the present invention, the titanium dioxide fine particles can be in any of the following states: the titanium dioxide fine particles contain an anionically active substance which is present in the vicinity of the surface of the fine particles, or an anionically active substance is adsorbed to the surface of a titanium dioxide fine particle, or an anionically active substance is present in the vicinity of the surface of titanium dioxide. See page 6, lines 13-17 of the present specification. This is why the fine particles of the present invention have an electrokinetic potential of from about -100mV to -10mV in an aqueous environment at a pH of 5.

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Accordingly, the present invention provides a photocatalytic powder and a photocatalytic slurry, which can exhibit not only excellent photocatalytic activity and durability, but also dispersion stability when coated on the surface of fiber, paper or plastic material, kneaded into such a material, or used for a coating composition. See page 3, lines 25-29 of the present specification.

On the other hand, Taoda et al '736 is directed to a photocatalytic powder comprised of finely divided titanium dioxide particles having a coating of porous calcium phosphate formed on at least part of the surface of each finely divided titanium dioxide particle, wherein an anionic surface active agent is present at least on the interface between the porous calcium phosphate coating and the finely divided titanium dioxide particle.

Taoda et al '736 is silent on the dispersion stability when the powder is coated on the surface of fiber, paper or plastic material, kneaded into such a material, or used for a coating composition. Taoda et al '736 only disclose that when the powder is supported on an organic polymer medium, the durability of the organic polymer medium is improved. See column 3, lines 4-11 of Taoda et al '736.

In Taoda et al '736, most of the anionic surface active agent must be present on the interface between the calcium phosphate and the finely divided titanium dioxide particle, because the anionic surface active agent improves the adhesive force of the porous calcium

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phosphate coating to the titanium dioxide particle. See column 4, lines 43-53 of Taoda et al '736.

Accordingly, Taoda et al '736 do not indicate a control of the electrokinetic potential on the fine particles. As a result, the dispersion stability can not be resolved.

From the above facts, it can be understood that the surface of the calcium phosphate coated fine particles in Taoda et al '736 is different from the surface of the fine particles of the present invention, because in the present invention most of the anionic active substance is present on the surface of the particles, whereas in Taoda et al '736 most of the anionic active substance must be present on the interface that exists between the calcium phosphate coating and the finely divided titanium dioxide particles, because the anionic surface active agent improves the adhesive force of the porous calcium phosphate coating to the titanium dioxide particle. See column 4, lines 43 to 53.

That is to say, the surface of the fine particle in Taoda et al '736 is comprised of calcium phosphate and titanium dioxide, and as a result the electrokinetic potential of the powder in Taoda et al '736 is outside of the claimed range in the present invention.

In the Advisory Action, the Examiner states that the calcium phosphate of Taoda et al is not excluded from the claimed photocatalytic powder because the present claims contain the open-ended phrase "comprising" in claims 1 and 2.

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In response, and as applicants have argued in the Response Under 37 C.F.R. § 1.116 filed on April 4, 2005, the calcium phosphate of Taoda et al affects the electrokinetic potential of the powders, and would cause the powders of Taoda et al to not have the electrokinetic potential recited in the present claims. The present claims, by positively reciting the electrokinetic potential, implicitly exclude components, structures and amounts which would cause the powders to not have the recited electrokinetic potential.

The Examiner has not addressed this argument.

In support of applicants' position that the calcium phosphate in Taoda et al, which as disclosed at column 5, lines 33 to 37 is preferably hydroxyapatite, would cause the powders of Taoda et al to not have the electrokinetic potential recited in the present claims, applicants have previously submitted with the Response Under 37116 filed on April 4, 2005, a copy of an article by Vasudevan et al, "Interaction of Pyrophosphates with Calcium Phosphates", *Langmuir*, Vol. 10, No. 1 (1994), pages 300 to 325. Figure 2 at page 321 shows that the electrokinetic potential of HAP (hydroxyapatite) at a pH of 5 is zero, which is outside the range of the present claims. Since the powders of Taoda et al contain calcium phosphate as a coating, applicants submit that one of ordinary skill in the art would expect that the powders of Taoda et al would not have the electrokinetic potential recited in the present claims.

Further, to the extent that the powders of Taoda et al contain titanium dioxide on their surface, this would not change the conclusion that one of ordinary skill in the art would expect that the powders of Taoda et al would not have the electrokinetic potential recited in the present

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claims. Applicants refer the Examiner to the following four documents, which were discussed in the Response Under 37116 filed on April 4, 2005, in support of their position.

(1) “Zeta Potential and Surface Charge Components at Anatase/Electrolyte Interface”, *Journal of Colloid and Interface Science*, Vol. 110, No. 1, (1986), pages 278 to 281, which shows at page 279, Fig. 1, that the electrokinetic potential of titanium dioxide in an aqueous environment at pH 5 is more than zero.

(2) S. Lee et al, *Journal of Membrane Science*, Vol. 201 (2002), page 193, which discloses that the point of zero charge of titania (TiO_2) has a pH of 6.25.

(3) A University of Alabama publication which contains a Figure that shows a point of zero charge at a pH of 6 (see Curve A of the Figure) for titania (titanium dioxide);

(4) U.S. Patent 4,241,042 to Matijevic et al, cited in the Information Disclosure Statement of December 2, 2003, discloses at column 7, lines 35 to 37, that the “particles of this invention [titanium dioxide] normally possess an electrokinetic point of zero charge at a pH in the range of from 4.0 to 5.5”.

Applicants submit that from these disclosures, one of ordinary skill in the art would conclude that the electrokinetic potential of titanium dioxide in an aqueous environment at a pH of 5 is zero or higher, and not within the scope of the present claims.

From the above facts, applicants submit that one of ordinary skill in the art would conclude that the electrokinetic potential of the powders in Taoda et al is zero or more than zero,

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and does not satisfy the recitation of the present claims that the fine particles have electrokinetic potential from about -100mV to -10mV in an aqueous environment at pH 5.

As can be seen from the above discussion, applicants submit that the powders of Taoda et al are not the same as those of the present claims because the present claims, by positively reciting the electrokinetic potential, implicitly exclude components, structures and amounts which would cause the powders to not have the recited electrokinetic potential, and that one of ordinary skill in the art would understand that the electrokinetic potential of the powders in Taoda et al would not satisfy the recitation of the present claims that the fine particles have and electrokinetic potential from about -100mV to -10mV in an aqueous environment at pH 5, especially since the powders of Taoda et al have calcium phosphate on their surface which affects the electrokinetic potential of the particles.

In view of the above, applicants submit that Taoda et al '736 do not defeat the patentability of claims 1 to 19 and, accordingly, request withdrawal of this rejection.

Claim 19 has been rejected under 35 U.S.C. § 103(a) as obvious over Taoda et al '736 in view of Suzuki et al.

Claim 19 is a dependent claim that depends ultimately from claim 1 or 2. Accordingly, applicants submit that claim 19 is patentable for the reasons discussed above in connection with the rejection of claims 1 and/or 2.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the

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Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.


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